

PHYSICAL ACTIVITY AND ITS ASSOCIATION WITH
SELECTED DIETARY BEHAVIORS

Amanda R. Cartwright, B.S.

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APPROVED:

James R. Morrow, Jr., Major Professor
Chwee Lye Chng, Committee Member
John R. Collins, Jr., Committee Member
Paul A. Nakonezny, Committee Member
M. Jean Keller, Dean of the College of Education
C. Neal Tate, Dean of the Robert B. Toulouse
School of Graduate Studies

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This study examined the association between level of physical activity and changes in dietary behaviors of 3,945 employees after a 10-week work-site physical activity program. Fifty-seven percent of the participants met the CDC/ACSM standard for physical activity sufficient for a health benefit. Physical activity was not significantly related to increased fruit and vegetable consumption, decreased dietary fat and calorie intake, and participants acquiring new nutrition skills. Physical activity was negatively associated with increased food label awareness. Participants who exercised sufficient for a health benefit were less likely to increase their food label awareness. Physical activity and dietary behaviors are generally not associated. Interventions to improve these behaviors should be behavior-specific.

Introduction

Achieving national health objectives depends on encouraging the adoption and maintenance of good health behaviors such as physical activity and healthy dietary habits. Understanding the relationship between physical activity and nutritional behaviors can be important to health educators and allied health personnel in general. Identification of this association can enable these individuals to design appropriate interventions to target the behavior or behaviors that need to be changed.

According to the 1996 Surgeon General's Report, lack of physical activity is a serious health problem. Each year up to 250,000 American deaths are attributed to a lack of regular physical activity. Thus, physical activity is an important component of a healthy lifestyle. Overall, individuals with moderate to high levels of physical activity or cardiorespiratory fitness show lower mortality and morbidity rates when compared to persons leading sedentary lifestyles or maintaining low cardiorespiratory fitness (U.S. Department of Health & Human Services, 1996). Furthermore, lack of physical activity increases the risk of coronary heart disease and other diseases (Whaley & Blair, 1995). Although the benefits of physical activity are clearly documented, only a small percentage of the population engages in aerobic exercise (Johnson & Ballin, 1996). In 1990, less than 10% of the population exercised three or more times a week at the level necessary to promote cardiovascular fitness (U.S. Public Health Service, 1990). It is recommended by the U.S. Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) that every adult accumulate 30 minutes or

more of moderate-intensity exercise on most, preferably all, days of the week (Pate et al., 1995). Moreover, according to the 1996 Surgeon General's Report more than 60% of American adults are not regularly active, and 25% of the adult population are not active at all (U.S. Department of Health & Human Services, 1996). In addition, the March 2001 Morbidity and Mortality Weekly Report states that in order to have "achieved recommended levels of physical activity, a person must have reported engaging in moderate-intensity physical activity greater than or equal to 5 times per week for greater than or equal to 30 minutes each time, vigorous-intensity physical activity greater than or equal to 3 times per week for greater than or equal to 20 minutes each time, or both during the preceding month" (MMWR, 2001, p. 166). Unfortunately, only 22% of adults are at a level of activity deemed sufficient for health benefit (U.S. Department of Health & Human Services, 1996).

Physical activity is not the only lifestyle behavior that needs to be improved. Consumption of foods high in dietary fat has been implicated as a causal factor in the etiology of many diseases and disease-risk factors, including coronary heart disease, hypertension, non-insulin-dependent diabetes mellitus, certain cancers, and obesity (Nissinen & Stanley, 1989). Thus, inclusion of nutritional behaviors in studies of healthy lifestyles is critical from a theoretical perspective because of its importance for morbidity and mortality (Patterson, Haines, & Popkin, 1994).

The solution to a healthy lifestyle seems simple; yet, for many individuals this lifestyle is not easily achieved. Traditional assessments of behavior modification depended on discrete measures based on assumptions that changes occur quickly,

dichotomously, and without relapse. Thus, individuals were expected to shift dramatically from unhealthy to healthy lifestyles. However, according to Prochaska and DiClemente (1982), the process of modifying or changing a behavior involves progression through a series of six stages (precontemplation, contemplation, preparation, action, maintenance, and termination). This concept is known as the Transtheoretical Model/Stages of Change. Moreover, within this model the first step to changing a person's behavior is knowing in which stage of change the individual is classified at the current time. Persons at different steps in the process of change can benefit from different intervention, matched to their specific stage. Marcus and colleagues (1996) examined the usefulness of using the stages of change model to explore physical activity adoption and maintenance over time. They concluded that interventions tailored specifically to subjects' stages of readiness to be physically active are most efficient for enhancing rates of participation in physical activity. Understanding the stages of exercise behavior change may afford crucial information for enhancing exercise adoption, adherence, and relapse prevention at both individual and public health levels. This also holds true for motivating changes in other health behaviors.

Two health behaviors often cited together are increased physical activity and dietary behaviors. These two behaviors affect caloric balance, which relates to changes in body weight. Additionally, both physical activity and dietary behaviors have been associated with increase morbidity and mortality. It is of interest whether these two behaviors are clustered or are independent lifestyle behaviors. This has implications for the delivery of health behavior interventions.

The purpose of this study is to examine the relationship between the amount of physical activity that is sufficient for health benefits and selected dietary behaviors after a ten-week nationwide physical activity program. This study is unlike others because it assesses the association of physical activity and selected dietary behaviors after a ten-week work-site physical activity program in which healthy nutrition was not specifically taught. Thus, a distinct relationship between improving diet along with physical activity may be investigated.

Association between Physical Activity and Selected Dietary Behaviors

To determine the relationship of physical activity and selected dietary behaviors, Patterson et al. (1994) performed a cluster analysis of 5,484 United States adults who completed the Nationwide Food Consumption Survey of 1987-1988. Of these adults, 25% had a good diet but were inactive, and 18% had a poor diet but high activity level. Thus, physical activity and a healthy diet were not associated.

Furthermore, Wilcox, King, Castro, and Bortz (2000) found similar results. They examined whether individuals who change their level of physical activity make corresponding changes in their diet. Their sample included 268 men and women aged 50-65 who participated in the Health Improvement Project I and 103 men and women who participated in a second trial. Within the one-year study, most participants adopted a healthier diet. They decreased their consumption of total calories, total fat, and saturated fat. However, changes in physical activity were not associated with changes in self-report measures of dietary behaviors. The researchers found no evidence to support the

concept that changes in physical activity are a gateway for changes in dietary behaviors in middle-aged and older adults (Wilcox, King, Castro, & Bortz, 2000).

A telephone survey of a national sample of 3,025 adults also revealed no association between 36 healthy behaviors such as exercise, nutrition, alcohol use, and dental care (Sobal, Revicki, & DeForge, 1992). Engaging in one health behavior was not associated with adopting another health behavior. They suggested efforts to promote healthy behaviors should be behavior-specific.

Shephard and Bouchard (1996) studied the relationship among healthy behaviors. Their sample consisted of 172 men and 178 women aged 14 to 68 years who were clinically healthy but relatively sedentary. The researchers discovered a weak association between physical activity and a healthy diet. Johnson and colleagues (1998) used the Blair Seven-Day Recall to conduct a similar study. Their findings suggested that physical activity had a modest association with dietary behaviors. Likewise, Johnson, Boyle, and Heller (1995) found that participation in leisure-time physical activity was weakly associated with following a special diet. The researchers concluded that the adoption of leisure activity promotes adoption of other good health practices.

Simoës et al. (1995) examined the relationship between dietary fat and leisure-time physical activity. The study sample consisted of 29,672 adults in the 1990 Behavioral Risk Factor Surveillance System. Dietary fat consumption was analyzed based on a 13-item questionnaire that listed the top contributors of dietary fat in adults. A total fat score was created based on multiplying the frequency of consumption by the number of grams of fat in a typical portion size and summing across all foods. Leisure-

time physical activity was obtained from answers to a self-reported questionnaire. The person's activity level was then categorized into one of four groups ranging from inactive to regular, intense activity. Simoes and colleagues (1995) concluded that dietary fat and physical activity were strongly and inversely associated. Furthermore, this relationship was independent of the effects of other demographic and behavioral risk factors. Simoes and colleagues believe that people who adopt one health behavior may be inclined to take up others as well.

Pate, Heath, Dowda, and Trost (1996) examined the associations between physical activity and other health behaviors in a nationally representative sample of 11,631 American high school students. Of these students, 14.1% were classified as low active and 22.8% were classified as high active. Activity classification was based on two questions from a self-administered seventy-item questionnaire. Those students who reported fewer than two days of light exercise and no days of hard exercise in the past fourteen days were classified as low active. Those students who reported six or more days of strenuous exercise and six or more days of light exercise were classified as highly active individuals. Pate et al. (1996) concluded that low physical activity was associated with poor dietary habits. Likewise, students who did not eat fruit and vegetables on the previous day were more likely to be low active. On the whole, the results of this study indicate that low levels of physical activity among American high school students are associated with several other important negative health behaviors such as lower fruit and vegetable consumption, cigarette smoking, and failure to wear a seat belt.

A more recent study had similar results (Gillman et al., 2001). This study was a cross-sectional analysis of the relationships between physical activity and dietary quality in 1,322 racially diverse men and women aged 25 to 91 years. Participants were categorized into 3 groups, vigorous, moderate, and sedentary, according to their reported intensity and duration of physical activity. Dietary quality was assessed by means of a validated food frequency questionnaire. A suboptimal diet was defined as consuming unhealthful quantities of at least 2 of the following 5 groups: fruits, vegetables, whole grain foods, whole-fat dairy foods, and red and processed meats. Results of this study showed that 57% of the participants were sedentary and 47% consumed a suboptimal diet. Moreover, sedentary individuals consumed smaller amounts of foods and nutrients considered to be healthful, such as fruits and vegetables, than more active participants. Thus, the researchers concluded that physical activity and diet quality are correlated behaviors.

Boutelle, Murray, Jeffery, Hennrikus, and Lando (2000) found interesting results when they studied the association between exercise and nutritional behaviors in a community sample of working adults. The sample consisted of 4,907 women and 4,136 men who completed surveys in 24 work-sites. Participants were divided into four leisure-time exercise groups, based on exercise scores, with approximately 1,000 men and 1,200 women in each group. The results suggested that only higher levels of leisure-time physical activity (top two quartiles) were associated with lower risk of consuming a high-fat diet. This indicates that there may be a level of exercise needed for associated changes to occur in dietary behaviors. In addition, Boutelle et al. (2000) stated that it is

possible that individuals who exercise at high levels may not need interventions focused on improving nutritional behaviors.

Mensink, Loose, and Oomen (1997) surveyed a representative sample of approximately 5,000 individuals and found a positive association between higher levels of leisure-time physical activity and a healthy lifestyle. The people who were active during leisure time consumed fruits, salads, whole grain breads, and vitamin supplements more often and consumed other breads and meats less often than people who were not active during leisure time. Thus, a healthy diet was directly related to high levels of leisure-time physical activity.

Matthews, Hebert, Ockene, Saperia, and Merriam (1997) also evaluated the relationship between leisure-time physical activity and selected dietary behaviors. Out of 900 adults studied, the active subjects (LTPA for at least 30 minutes every week) consumed less servings per week of meats, fried foods, sweets, and 2-4% milk than inactive individuals. Active individuals also consumed more servings of fruits, vegetables, low-fat dairy products, and 0-1% milk than did inactive individuals. Therefore, Matthews and colleagues (1997) concluded that leisure-time physical activity is associated with healthy dietary behaviors. Eaton et al. (1995), in a cross-sectional study of about 2,000 participants, also found that moderately active and very active individuals ate a healthier diet (more fiber, less total fat, more fruits and vegetables, and more vitamins) than sedentary individuals.

Blundell and Cooling (2000) studied various routes leading to obesity. They found that individuals who ate a high-fat diet had a lower physical activity level and

significantly more periods of sedentary behavior than individuals who ate a low-fat diet.

Thus, Blundell and Cooling concluded that physical activity is related to a healthy diet.

Lowry et al. (2000) also found a positive association between diet and exercise among 4,609 undergraduate college students. Males and females who reported using exercise to lose weight or to keep from gaining weight were more likely than those who did not use exercise to eat five or more servings of fruits and vegetables per day and two or less servings of high-fat foods per day. Again, these results suggest a relationship between diet and physical activity.

Work-site Health Promotion

In order to meet the Surgeon General's health goals for the nation, there needs to be effective ways of getting adults involved in physical activity. The work-site may be a viable place to encourage physical activity, since most adults are employed outside the home. In 1986, Blair, Piserchia, Wilbur, and Crowder compared the daily energy expenditure of 1,399 individuals who participated in a work-site health promotion program with 748 individuals who received only an annual health screen. The employees who were exposed to the two-year health promotion program showed an 104% increase in total daily energy expenditure in vigorous activity, compared with a 33% increase among employees who received only the annual health screen. Vigorous exercise was defined as participating in various activities that have an energy cost of approximately 1,000 kcal per week. Overall, the key finding of this study was that a work-site health promotion intervention produces impressive improvements in physical activity, and can

make a substantial contribution toward achieving the nation's health goals for exercise and physical fitness.

Data from the Healthy Worker Project (HWP), a randomized trial of work-site interventions for weight loss and smoking cessation that was conducted in 32 work-sites over a period of two years, was used to examine the association between concurrent changes in nutritional behaviors and physical activity in a sample of 3,672 adults (Schmitz, French, & Jeffery, 1997). Results indicated that increases in high-fat/calorie food intake were associated with increases in physical activity among men, but not women. Consuming high-fat/calorie foods is not consistent with a healthy diet. Therefore, among men, this study showed no evidence that increasing physical activity is associated with improving nutritional behaviors.

Shah et al. (1993) used that same database, HWP, to examine the behavioral and sociodemographic correlates of high fat/calorie food consumption. A sample of 4,373 adults participated in this work-site weight loss intervention. The results indicated that physical activity was associated with higher intakes of high fat/calorie foods.

Health Behavior Change Models

Public health and health promotion programs can help improve health, decrease risks of disease, control chronic illnesses, and enhance the well-being of individuals. However, not all health promotion programs are equally successful. Programs that are based on a clear understanding of the targeted health behaviors and their environmental context are most likely to succeed. These successful programs are developed and managed using strategic planning models, and they are continually improved via

meaningful evaluation. Thus, theories of health behavior can play a vital role in developing behavior change programs.

A majority of health promotion theories are derived from the social and behavioral sciences, but their application usually requires knowledge of epidemiology and physical sciences. Unfortunately, many of these theories are not highly developed or lack sufficient testing. Consequently, no single theory dominates health education and promotion.

The Theory of Cognitive Dissonance states that individuals have a tendency to seek consistency among their beliefs, values, and perceptions (Festinger, 1957). When inconsistency arises between attitudes or behaviors, something must change to eliminate the dissonance. This change commonly takes the form of altering the original attitude to accommodate the behavior. Likewise, when individuals behave differently, they will also change their attitudes about themselves. Festinger (1957) proposes that people are motivated to change and act consistently with their beliefs, values, and perceptions when there is psychological inconsistency between two pieces of information. Although the Theory of Cognitive Consistency provides important information for health educators it is limited because people appear to tolerate dissonance between personal knowledge and behavior (Simons-Morton, Greene, & Gottlieb, 1995). Individuals are just as likely to change their knowledge and attitudes to be consistent with their behavior as they are to modify their behavior to be consistent with new information. Furthermore, this model does not explain the relationship between knowledge, attitudes, and health behavior, and does not take into account the effects of reinforcement and environmental factors.

The Health Belief Model was formulated in the 1950s by Hochbaum, Kegeles, Leventhal, and Rosenstock (Rosenstock, 1966). It has been regarded as the beginning of systematic, theory-based research in health behavior (Rosenstock, 1990). The Health Belief Model explains and predicts preventive health behavior, and focuses on the relationship of health behaviors, practices and utilization of health services, and general health motivation to differentiate illness and sick-role behavior from health behavior (Rosenstock, 1966).

The Theory of Reasoned Action is a behavioral change model that explores ways to predict and understand healthy and unhealthy behaviors and outcomes, and it looks at behavioral intentions as the most important determinant of a person's behavior (Fishbein & Ajzen, 1980). Behavioral intention is best determined by the individual's expectancies regarding the outcome of a behavior, other attitudes toward the behavior, and "normative" beliefs the individual may have. However, this model did not work with people who have little or feel they have little power over their behaviors and attitudes (O'Donnell & Harris, 1994). Thus, the Theory of Planned Behavior was developed in 1988 to predict and understand motivational influences on behavior that is not under volitional control (Ajzen, 1988). There are several limitations to Ajzen and Fishbein's theories (O'Donnell & Harris, 1994). First, factors such as personality and demographic variables are not taken into consideration. Secondly, ambiguity regarding how to define perceived behavioral control creates measurement problems. Finally, the theory is based on the assumption that people are rational and make systematic decisions based on available information. Unconscious motives are not considered.

The Communications-Persuasion Model looks at the influence of mass media and other forms of public communication on individuals' attitudes and behaviors (McGuire, 1984). This behavior change model is based on the assumption that knowledge change is a prerequisite for attitude change, which in turn is a necessary precondition for decision-making and behavior change. Furthermore, the Communications-Persuasion Model has been one of the most influential models in public health promotion efforts (Elder, Geller, Hovell, & Mayer, 1994).

The Field Theory describes behavior in terms of the present situations in which individuals find themselves as well as the needs they bring to those situations (Lewin, 1951). Lewin argued that a person's needs were of greater importance than stimulus-response associations. However, Bandura (1986) subsequently demonstrated how these ideas overlap.

Strict behaviorism supports a direct and unidirectional pathway between stimulus and response, representing human behavior as a simple reaction to external stimuli. Rotter's Social Learning Theory (1966) asserts that there is a mediator (human cognition) between stimulus and response, placing individual control over behavioral responses to stimuli. According to this theory, individuals learn on the basis of one's history of reinforcement. Through a learning process, individuals form the belief that certain outcomes are a result of their action (internals) or a result of other forces independent of themselves (externals). In the early 1900s, Adler introduced several concepts that are upheld in the current Social Learning Theory. He stated that a person's behavior is purposeful and motivated by a pursuit of goals. Moreover, Adler emphasized the

importance of one's perception of, and attitude toward, the environment as notable influences on behavior.

The Health Locus of Control Theory is a spin-off of Rotter's Social Learning Theory (Wallston & Wallston, 1978). Wallston and Wallston (1978) developed the first health related locus of control measure out of the difficulty in predicting health behavior from generalized expectancies. The Health Locus of Control scale is a unidimensional measure of people's beliefs that their health is or is not determined by their own behavior. This scale is recommended in conjunction with behavioral measures to evaluate health education programs.

The Social Cognitive Theory also stemmed from the Social Learning Theory (Bandura, 1986). It was developed to identify methods in which behavior could be modified or changed. According to this theory, behavior is explained by a triadic, dynamic reciprocal theory in which personal factors, environmental influences, and behavior continually interact. The emphasis on one's cognitions suggests that the mind is an active force that constructs one's reality, selectively encodes information, performs behavior on the basis of values and expectations, and imposes structure on its own actions. However, this model of causation as proposed via the social cognitive theory is very comprehensive and complex which makes it difficult to operationalize (Simons-Morton, Greene, & Gottlieb, 1995).

Ecological Models of Health Behavior and Health Promotion are multifaceted which may enhance program effectiveness. These models are concerned with environmental change, behavior, and policy that help individuals make healthy choices in

their daily lives. Consideration of the physical environment and its relationship to people at individual, interpersonal, organizational, and community levels uniquely define these models.

Roger's Diffusion of Innovations Theory (1995) helps to explain the process of social change. An innovation is defined as an idea, practice, or object that is perceived as new by an individual or other unit of adoption. The perceived newness of the idea for the individual is the determinant of one's reaction to it. Furthermore, diffusion is defined as the process by which an innovation is communicated through certain channels over time among the members of a social system. Thus the four major elements of this theory are the innovation, communication channels, time, and the social system. The stages of adoption (awareness, interest, trial, decision, and adoption) appear to be very similar to Prochaska and DiClemente's Stages of Change (1982).

The Transtheoretical Model/Stages of Change Model was developed by Prochaska and DiClemente (Prochaska, 1979). This model of intentional behavior change has been the foundation for developing effective interventions to promote health behavior change. It describes how individuals modify a problem behavior or acquire a positive behavior. In addition, the Transtheoretical Model involves emotions, cognitions, and behaviors, as well as a reliance on self-report. Likewise, accurate measurement requires a series of unambiguous items that the individual can respond to accurately with little opportunity for distortion. Moreover, Prochaska and DiClemente's model construes change as a process involving progress through a series of six stages: precontemplation, contemplation, preparation, action, maintenance, and termination. The model makes no

assumption about the readiness of individuals to modify or change a behavior. It recognizes that individuals may be in different stages and that appropriate interventions must be developed for everyone (Marcus, Simkin, Rossi, & Pinto, 1996). In addition, understanding the stages of exercise behavior may yield valuable information for increasing rates of participation in physical activity (Marcus & Simkin, 1993). The amount of progress participants make as a consequence of the intervention tends to be a function of the stage they are in at the start of the program (Marcus & Simkin, 1994). Likewise, very high participation rates in physical activity programs have been achieved as a consequence of using this model. Interventions based on this model have the potential to have both a high efficacy and a high recruitment rate, thus dramatically increasing the potential impact on entire populations of individuals with behavioral health risks.

In sum, the aforementioned research suggests that there is a need for behavior modification to enhance the well-being of individuals. Physical activity and dietary behaviors are two important lifestyle factors that can be modified in order to decrease risks of diseases. To reach a large population of individuals, health educators rely on work-site health promotion programs. However, because there are many models of behavior change, health educators must be knowledgeable about the target population in order to provide the most successful program. Studies examining the usefulness of Prochaska and DiClemente's Stages of Change Model to explore exercise adoption and maintenance have had positive results (Marcus, Simkin, Rossi, & Pinto, 1996). Thus,

this model will be used in the current study to assess participants' levels of physical activity.

Method

The National Coalition for Promoting Physical Activity (NCPA) designed "March Into May" (MIM) during Spring, 1999, as a work-site based physical activity program. MIM was the secondary part of a national goal setting and behavior modification campaign called "Take Charge Challenge". This campaign was based on the 1996 Surgeon General's report on physical activity and health. Data from MIM were used in this research.

Participants in the 10-week MIM were instructed to set individual goals to engage in self-set moderate to vigorous physical activity. Moderate physical activity included exercise like brisk walking, gardening, slow cycling, doubles tennis, or hard housework, and was defined as brisk walking lasting ten minutes in duration. Vigorous activity was defined as intensity level equivalent to jogging for at least thirty minutes and included activities such as running, aerobics, singles tennis, and racquetball. To increase physical activity among employees, MIM was conducted in a group format. Once implemented, the goal of MIM was to help employees attain the CDC/ACSM recommendation of thirty minutes or more of moderate physical activity most days of the week or three days of vigorous activity per week. Level of physical activity was assessed with the stages of change (Transtheoretical) model. Also, MIM sought to create a work environment that promoted healthy behaviors.

Two months prior to implementation of MIM, the NCPPA began to recruit worksites for the program. Invitations to participate in MIM were given to 54 private corporations. Through a process conducted by the CDC, 12 public health departments were self-selected. The American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD) chose four schools, and the Office of Federal Occupational Health selected five federal sites. All in all, a total of 9,512 employees from 23 sites (10 corporations, 10 public health departments, 2 federal sites, and 1 middle school) agreed to participate in MIM after receiving the mailed participation letter and fact sheet from NCPPA. Once corporate agreement was made to participate, companies selected their own management support, MIM program directors, and MIM program committee. The NCPPA provided training and materials to the program directors. All program directors were employee volunteers, and one month prior to implementing MIM, each program committee selected team captains. Team captains were responsible for a team of employees; the number of teams depended on size of the company, number of participants, and available resources. The number of teams ranged from four to 85, and team size varied between 5-42 employees. MIM was promoted to all of the employees two weeks before the physical activity program began.

Data Collection and Analysis. At the conclusion of the ten-week physical activity program, team captains administered a program evaluation questionnaire, which was developed by representatives of the NCPPA, to all participants. Of the participants, 3,945 completed the questionnaire giving a response rate of 41%. On the survey, physical activity was assessed by an item based on the stages of change model (Marcus et

al., 1996). The participants were asked to choose one of five statements that best described their current level of physical activity (see Appendix A). This item was dichotomized into 0 or 1 according to health benefit. The first three choices indicate that the individual did not engage in physical activity sufficient to receive a health benefit. The last two statements indicate that the individual does meet the CDC/ACSM guidelines for physical activity that is sufficient for a health benefit. Bowles, Morrow, Lochmann, and Jackson (2001) tested the reliability of this single-item measure of physical activity. Participants answered the 5-level physical activity question and were dichotomized as either not meeting or meeting CDC/ACSM physical activity guidelines. Seven days later, the participants were re-tested and the dichotomized responses to the first and second administrations were compared. The reliability of this item was found to be 91% agreement, with a phi coefficient and percent of max Kappa of .80. Chi-square analysis ($p < .001$) indicates that this agreement is significant.

Furthermore, a seven-part item was used to determine changes in dietary behaviors. Participants were asked to respond yes or no to five selected dietary behaviors based on whether or not it occurred during their participation time in MIM (see Appendix B). For the purpose of this study, only dietary statements one through five will be analyzed. Participants that answered yes to statement six were eliminated from the analysis because they decided that they did not need to change their dietary habits. Statement seven deals with smoking, which is not relevant for the current study. Chi square analyses and t-tests were used to determine the relationship between physical activity and selected nutritional behaviors. Level of physical activity was the

independent variable in this study and changes in dietary behaviors were the dependent variables.

Results

From the total sample of 3,426 participants, 57% meet the CDC/ACSM standard for physical activity sufficient for a health benefit (see Table 1). Table 2 shows the percentage of participants who made selected dietary behavior changes during the 10-week physical activity program. The greatest dietary change was an increase in the consumption of fruits and vegetables (45%). However, cross-tabulations show that most individuals, regardless of exercise status, did not make any associated changes in their dietary behavior (see Table 3). The association between physical activity and an increase in food label awareness was statistically significant. Twenty-seven percent of those participants who were physically active sufficient for a health benefit changed their food label awareness, and 30% of the participants who did not meet the physical activity standard changed their food label awareness.

An independent groups t-test was conducted to determine if the total number of changes in dietary behavior was a function of physical activity status. The total score (possible range of 0-5) had an alpha coefficient of .60. The results [$t(3424) = 1.72, p < .09$] indicated no association between total dietary changes and physical activity status. Mean scores for number of changes were 1.64 ± 1.4 and 1.56 ± 1.4 for those performing insufficient and sufficient physical activity for a health benefit, respectively ($ES = .06$). Table 4 presents the frequency distribution for total number of changes.

Table 1 - Current Level of Physical Activity Among All Participants				
	Stage of Change	N	%	
No and not thinking about exercise	Precontemplation	13	0.4	43%
No but thinking	Contemplation	162	4.7	
Insufficient exercise	Planning	1310	38.2	
Exercise sufficient for a health benefit for ≤ 6 months	Action	935	27.3	57%
Exercise sufficient for a health benefit for > 6 months	Maintenance	1006	29.4	

Table 2 - Percentage of participants who indicated a change in dietary behavior during the physical activity program		
	N	%
Increased your fruit and vegetable consumption	1546	45.1
Decreased your dietary fat intake	1360	39.7
Reduced your calorie intake	1150	33.5
Become more aware of nutrition labels on food products	963	28.1
Acquired new nutrition skills (such as low-fat recipes and foods, bringing healthy lunches to work, etc.)	453	13.2

Table 3 - The association between physical activity and changes in selected dietary behaviors ^a			
Behavior	phi	χ^2	p <
Increased your fruit and vegetable consumption	-.01	0.33	.57
Decreased your dietary fat intake	-.01	0.24	.63
Reduced your calorie intake	-.02	1.44	.23
Become more aware of nutrition labels on food products	-.04	5.31	.02
Acquired new nutrition skills (such as low-fat recipes and foods, bringing healthy lunches to work, etc.)	-.01	0.61	.44
^a N = 3426, df = 1			

Table 4 - Descriptive Statistics for Total Number of Dietary Changes		
Nutrition Score	Frequency	Percentage
0	1008	29.4%
1	778	22.7%
2	700	20.4%
3	466	13.6%
4	474	13.8%

Discussion and Conclusions

Physical activity is an important component of a healthy lifestyle. It is associated with numerous health benefits (Johnson & Ballin, 1996). Data from the Morbidity and Mortality Weekly Report (2001) show that in 1998 the prevalence of those who engaged in recommended levels of physical activity was 25%, and the prevalence of those reporting insufficient physical activity was 46%. In the same year, 29% of the individuals reported engaging in no physical activity. However, within the current study 57% of the participants reported physical activity sufficient for a health benefit, 38% of the participants were physically active, but not enough for a health benefit, and only 5% reported no physical activity at all. The higher rate of physical activity in the current subjects, as compared to the general population, may be due to the fact the current participants were in a program that promoted physical activity. Work-site physical activity programs have been shown to be effective in increasing the percentage of employees that engage in physical activity (Blair, 1986). This program was also conducted in a group format, which may have added to its success. Toropainen and Rinne (1998) concluded that the promotion of physical activity group work is most effective if it is based on a mutual interaction between the group members.

Evaluation of motivationally tailored versus standard self-help physical activity interventions at the workplace showed that individuals receiving motivationally tailored intervention were significantly more likely to show increases in their stage of readiness for exercise adoption (37% vs. 27%) (Marcus et al., 1998). Accordingly, the current program was based on Prochaska and DiClemente's Stages of Change model (1982).

Interventions tailored specifically to a person's stage of readiness to be physically active are most efficient for enhancing rates of participation in physical activity (Marcus, Simkin, Rossi, & Pinto, 1996). Thus, a person's readiness to change and behavior change strategies need to be considered and incorporated into social support structures to facilitate individual behavior change (Biddle & Fox, 1998; Cole, Leonard, Hammond, & Fridinger, 1998).

The association between health behaviors is also vital to designing behavior change programs. This study found no association between physical activity and an increase in fruit and vegetable consumption, a decrease in dietary fat and calorie intake, and acquiring new nutrition skills such as low-fat recipes and foods. There was, however, an association between physical activity and food label awareness. Participants who were physically active enough to receive a health benefit were less likely to increase their food label awareness than those participants who were insufficiently active ($p < .02$). In the current study, 27% of those participants who were physically active sufficient for a health benefit changed their food label awareness, while 30% of the participants who did not meet the physical activity standard changed their food label awareness. Logistic regression revealed that the odds of changing food label awareness were reduced by 16% ($OR = .84$; 95% $CI = .72 - .97$) when an individual met the standard for physical activity. Individuals who are physically active sufficient for a health benefit may feel that they do not need to change their dietary behaviors, while individuals who are insufficiently active may compensate for this deficiency by changing their dietary behaviors.

Within the limitations in this study, the most important finding is that level of physical activity was not generally related to a change in selected dietary behaviors. Therefore, each behavior, diet and physical activity, requires its own intervention. Several studies have examined the relationship between physical activity and dietary behaviors. Yet, there have been mixed results. Blundell and Cooling (2000), Dinger and Vesely (2001), Lowry et al. (2000), Matthews et al. (1997), Pate et al. (1996), and Simoes et al. (1995) found that physical activity and dietary behaviors were related. Thus, the authors concluded that a change in one of these health behaviors would lead to a change in the other health behavior. If this were the case, health promotion professionals should consider designing interventions that target both of these behaviors.

Other similar studies (Sobal, Revicki, & DeForge [1992]; Wilcox, King, Castro, & Bortz, [2000]), including the present one, found little evidence that physical activity and dietary behaviors are associated. Being physically active does not mean that a person will also enhance dietary behavior. Thus, a change in one health behavior was not related to a change in the other health behavior. Each lifestyle behavior needs to be taught separately for a change to be seen in each behavior. Furthermore, health professionals can not assume that individuals who change physical activity behavior will want to change specific dietary behaviors.

There were several limitations in the current study. Demographic information and baseline data were not collected on the participants. Thus, differences among the participants, such as gender and ethnicity, can not be analyzed and the results can not be generalized to other sub-populations. As with all self-report data, selective reporting

could be a threat to internal validity. Additionally, there was no control group, no matching of subjects, and history effect that could have impacted the internal validity of the research.

In conclusion, the findings of this study suggest that physical activity and selected dietary behaviors are not associated, and thus, need to be taught separately or in combination. This result may be of value as health professionals search for associations between health behaviors. Understanding the association between and among health-related behaviors will enable health education and promotion professionals to design appropriate interventions to target behaviors. Future research should include a similar study design that incorporates demographic and baseline data. This will enable the researchers to better describe their study population, and compare their sample with subgroups of the population.

References

- Ajzen, I. (1988). Attitudes, personality, and behavior. Chicago: Dorsey.
- Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice Hall.
- Biddle, S. J., & Fox, K. R. (1998). Motivation for physical activity and weight management. International Journal of Obesity Related Metabolic Disorders, 22, 39-47.
- Blair, S. N., Piserchia, P. V., Wilbur, C. S., & Crowder, J. H. (1986). A public health intervention model for work-site health promotion. Journal of the American Medical Association, 255, 921-926.
- Blundell, J. E., & Cooling, J. (2000). Routes to obesity: Phenotypes, food choices and activity. British Journal of Nutrition, 83 (Supplement), S33-S38.
- Boutelle, K. N., Murray, D. M., Jeffery, R. W., Hennrikus, D. J., & Lando, H. A. (2000). Associations between exercise and health behaviors in a community sample of working adults. Prevention Medicine, 30, 217-224.
- Bowles, H. R., Morrow, J. R. Jr., Lochmann, A. C., & Jackson, A. W. (2001). Criterion-referenced reliability of single-item self-reported measures of physical activity. Manuscript submitted for publication.
- Cole, G., Leonard, B., Hammond, S., & Fridinger, F. (1998). Using “stages of behavioral change” constructs to measure the short-term effects of a worksite-based intervention to increase moderate physical activity. Psychology Reports, 82, 615-618.

- Dinger, M. K., & Vesely, S. K. (2001). Relationships between physical activity and other health-related behaviors in a representative sample of U. S. college students. American Journal of Health Education, 32, 83-88.
- Eaton, C. B., McPhillips, J. B., Gans, K. M., Garber, C. E., Assaf, A. R., Lasater, T. M., & Carleton, R. A. (1995). Cross-sectional relationship between diet and physical activity in two southeastern New England communities. American Journal of Preventative Medicine, 11, 238-244.
- Elder, J. P., Geller, E. S., Hovell, M. F., & Mayer, J. A. (Eds.). (1994). Motivating health behavior. New York: Delmar.
- Festinger, L. (1957). A theory of cognitive dissonance. Stanford, CA: Stanford University.
- Fishbein, M., & Ajzen, I. (1980). Understanding attitudes and predicting social behavior. Englewood Cliffs, NJ: Prentice-Hall.
- Gillman, M. W., Pinto, B. M., Tennstedt, S., Glanz, K., Marcus, B., & Friedman, R. H. (2001). Relationships of physical activity with dietary behaviors among adults. Preventive Medicine, 32, 295-301.
- Johnson, J. M., & Ballin, S. D. (1996). Surgeon General's report on physical activity and health is hailed as a historic step toward a healthier nation. Circulation, 94, 2045.
- Johnson, M. F., Nichols, J. F., Sallis, J. F., Calfas, K. J., & Hovell, M. F. (1998). Interrelationships between physical activity and other health behaviors among university women and men. Prevention Medicine, 27, 536-544.

- Johnson, N. A., Boyle, C. A., & Heller, R. F. (1995). Leisure-time physical activity and other health behaviours: Are they related? Australian Journal of Public Health, 19, 69-75.
- Lewin, K. (1951). The nature of the field theory. In M. H. Marx (Ed.), Psychological theory. New York: Macmillan.
- Lowry, R., Galuska, D. A., Fulton, J. E., Wechsler, H., Kann, L., & Collins, J. L. (2000). Physical activity, food choice, and weight management goals and practices among US college students. American Journal of Preventative Medicine, 18, 18-27.
- Marcus, B. H., Emmons, K. M., Simkin-Silverman, L. R., Linnan, L. A., Taylor, E. R., Bock, B. C., Roberts, M. B., Rossi, J. S., & Abrams, D. B. (1998). Evaluation of motivationally tailored vs. standard self-help physical activity interventions at the workplace. American Journal of Health Promotion, 12, 246-253.
- Marcus, B. H., & Simkin, L. R. (1993). The stages of exercise behavior. Journal of Sports Medicine and Physical Fitness, 33, 83-88.
- Marcus, B. H., & Simkin, L. R. (1994). The transtheoretical model: Applications to exercise behavior. Medical Science for Sports and Exercise, 11, 1400-1404.
- Marcus, B. H., Simkin, L. R., Rossi, J. S., & Pinto, B. M. (1996). Longitudinal shifts in employees' stages and processes of exercise behavior change. American Journal of Health Promotion, 3, 195-200.
- Matthews, C. E., Hebert, J. R., Ockene, I. S., Saperia, G., & Merriam, P. A. (1997). Relationship between leisure-time physical activity and selected dietary variables in

- the Worcester Area Trial for Counseling in Hyperlipidemia. Medical Science for Sports and Exercise, 29, 1199-1207.
- Mensink, G. B., Loose, N., & Oomen, C. M. (1997). Physical activity and its association with other lifestyle factors. European Journal of Epidemiology, 13, 771-778.
- McGuire, W. J. (1984). Public communication as a strategy for inducing health promoting behavior change. Prevention Medicine, 13, 299-313.
- Morbidity and Mortality Weekly Report. (March 9, 2001). Atlanta: Centers for Disease Control and Prevention and U. S. Department of Health and Human Services.
- Nissinen, A., & Stanley, K. (1989). Unbalanced diets as a cause of chronic diseases. American Journal of Clinical Nutrition, 49, 993-998.
- O'Donnell, M. P., & Harris, J. S. (Eds.). (1994). Health promotion in the workplace. New York: Delmar.
- Pate, R. R., Heath, G. W., Dowda, M., & Trost, S. G. (1996). Associations between physical activity and other health behaviors in a representative sample of US adolescents. American Journal of Public Health, 86, 1577-1581.
- Pate, R.R., Pratt, M., Blair, S. N., Haskell, W. L., Macera, C. A., Bouchard, C., Buchner, D., Ettinger, W., Heath, G. W., King, A. C., Kriska, A., Leon, A. S., Marcus, B. H., Morris, J., Paffenbarer, R. S., Patrick, K., Pollock, M. L., Rippe, J. M., Sallis, J., & Wilmore, J. H. (1995). Physical activity and public health. Journal of the American Medical Association, 273, 402-408.
- Patterson, R. E., Haines, P. S., & Popkin, B. M. (1994). Health lifestyle patterns of U.S. adults. Prevention Medicine, 23, 453-460.

- Prochaska, J. O. (1979). Systems of psychotherapy: A transtheoretical analysis. Pacific, CA: Brooks-Cole.
- Prochaska, J. O., & DiClemente, C. C. (1982). Transtheoretical therapy toward a more integrative model of change. Psychotherapy: Theory, Research and Practice, 19, 276-287.
- Rogers, E. (1995). Diffusion of innovations (4th edition). New York, NY: Free Press.
- Rosenstock, I. M. (1966). Why people use health services. Milbank Memorial Fund Quarterly, 11, 94-124.
- Rosenstock, I. M. (1990). The health belief model: Explaining health behavior through expectancies. In K. Glanz, F. M. Lewis, & B. K. Rimer (Eds.), Health behavior and health education: Theory, research, and practice. San Francisco: Jossey-Bass.
- Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs, 80, 1-28.
- Schmitz, K., French, S. A., & Jeffery, R. W. (1997). Correlates of changes in leisure time physical activity over 2 years: The Healthy Worker Project. Prevention Medicine, 24, 570-579.
- Shah, M., French, S. A., Jeffery, R. W., McGovern, P. G., Forster, J. L., & Lando, H. A. (1993). Correlates of high fat/calorie food intake in a worksite population: The healthy worker project. Addictive Behaviors, 18, 583-594.
- Shephard, R. J., & Bouchard, C. (1996). Associations between health behaviors and health related fitness. British Journal of Medicine, 30, 94-101.

- Simoes, E. J., Byers, T., Coates, R. J., Serdula, M. K., Mokdad, A. H., & Heath, G. W. (1995). The association between leisure-time physical activity and dietary fat in American adults. American Journal of Public Health, 85, 240-244.
- Simons-Morton, B. G., Greene, W. H., & Gottlieb, N. H. (1995). Introduction to health education and health promotion (2nd ed.). Prospect Height, IL: Waveland.
- Sobal, J., Revicki, D., & DeForge, B. R. (1992). Patterns of interrelations among health promotion behaviors. American Journal of Preventative Medicine, 8, 351-359.
- Toropainen, E., & Rinne, M. (1998). What are groups all about?—Basic principles of group work for health-related physical activity. Patient Education Counselor, 33, 105-109.
- United States Public Health Service. (1990). Healthy People 2000: National health promotion and disease prevention objectives. Washington: U.S. Government Printing Office, DHHS Publication No. (PHS) 91-50212.
- U.S. Department of Health and Human Services. (1996). Physical activity and health: A report of the Surgeon General. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.
- Wallston, B. S., & Wallston, K. A. (1978). Locus of control and health: A review of the literature. Health Education Monographs, Spring, 107-117.
- Whaley, M. H., & Blair, S. N. (1995). Epidemiology of physical activity, physical fitness and coronary heart disease. Journal of Cardiovascular Risk, 2, 289-295.

Wilcox, S., King, A. C., Castro, C., & Bortz, W. (2000). Do changes in physical activity lead to dietary changes in middle and old age? American Journal of Preventative Medicine, 18, 276-283.

APPENDIX A

MEASURE OF CURRENT LEVEL OF PHYSICAL ACTIVITY

Appendix A. Measure of Current Level of Physical Activity^a

Please read the next five statements. Mark (X) by the one statement that best describes your current level of physical activity.

- ☐ I don't exercise or walk regularly now, and I don't plan to start in the near future.
- ☐ I don't exercise or walk regularly, but I've been thinking about starting.
- ☐ I'm doing moderate physical activity fewer than 5 times a week, or vigorous ones fewer than 3 times a week.

"Vigorous" exercise includes activities like jogging, running, fast cycling, aerobics, swimming laps, singles tennis and racquetball. Count any activity that makes you work as hard as jogging and lasts at least 20 minutes at a time. These types of activities usually increase your heart rate, make you sweat and make you feel out of breath. (Don't count weight lifting).

"Moderate" exercise includes activities such as brisk walking, gardening, slow cycling, dancing, doubles tennis or hard work around the house. Count any activity that makes you work as hard as brisk walking and that lasts at least 10 minutes at a time.

- ☐ I've been doing moderate physical activities 5 or more times a week, or vigorous ones at least 3 times a week, for the last 1 to 6 months.
- ☐ I've been doing moderate physical activities 5 or more times a week, or vigorous exercise at least 3 times a week, for 7 months or longer.

^a The first three statements DO NOT meet CDC/ACSM guidelines for physical activity sufficient to receive a health benefit. The last two statements, four and five, DO meet the CDC/ACSM guidelines.

APPENDIX B
CHANGE IN DIETARY BEHAVIORS

Appendix B. Change in Dietary Behaviors

During the time you participated in MIM, have you: Mark (X) ALL that apply

- ☐ Increased your fruit and vegetable consumption
- ☐ Decreased your dietary fat intake
- ☐ Reduced your calorie intake
- ☐ Become more aware of nutrition labels on food products
- ☐ Acquired new nutrition skills (such as low-fat recipes and foods, bringing healthy lunches to work, etc.)
- ☐ Decided you did not need to change dietary habits^a
- ☐ Reduced or stopped smoking^b

^a If the participant answered yes to this question then he/she was omitted from the analysis.

^b This question was not included in the analysis.